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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/674,960	09/30/2003	Robert Starkston	884.949US1	5313
21186 7590 09/09/2009 SCHWEGMAN, LUNDBERG & WOESSNER, P.A. P.O. BOX 2938 MINNEAPOLIS, MN 55402				
EXAMINER HEINRICH, SAMUEL M				
ART UNIT 3742		PAPER NUMBER		
NOTIFICATION DATE 09/09/2009		DELIVERY MODE ELECTRONIC		

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte ROBERT STARKSTON, ANDREW PROCTOR, and
STEVE TERRY

Appeal 2009-001078
Application 10/674,960
Technology Center 3700

Decided: September 4, 2009

Before WILLIAM F. PATE, III, LINDA E. HORNER, and
STEVEN D.A. McCARTHY, *Administrative Patent Judges*.

HORNER, *Administrative Patent Judge*

DECISION ON APPEAL

STATEMENT OF THE CASE

Robert Starkston et al. (Appellants) seek our review under 35 U.S.C. § 134 of the Examiner's decision rejecting claims 16-21, 23-27, and 29-38, which are all of the pending claims. We have jurisdiction under 35 U.S.C. § 6(b) (2002).

SUMMARY OF DECISION

We AFFIRM-IN-PART.

THE INVENTION

The Appellants' claimed invention is a method and apparatus for laser scribing wafers before singulating wafers to produce individual die or chips. Spec. 1:7-8. During semiconductor manufacturing, a number of identical element devices are formed on a single wafer, and then the wafer is sliced and diced (i.e., singulated) with a diamond saw to produce individual wafer portions known as die or chips. Spec. 1:14-30. The cut lines for slicing and dicing a wafer are scribed using a laser prior to singulation to remove fragile materials without leaving mechanical defects in the device edge. Spec. 1:27-Spec. 2:5. Multiple parallel scribe lines are placed next to one another to remove material which is wider than the kerf (i.e., width) of the diamond saw blade. Spec. 2:6-10. When the laser scribe lines are placed one next to the other, a plume from the laser scribing process can settle on the solder for the leads to the circuitry within the die or chip, and may interfere with or prevent electrical connection to the leads. Spec. 2:10-20. The Appellants'

invention employs a method and apparatus to form the laser scribe lines in a particular order. Independent claims 16, 23, 29, and 32 are reproduced below.

16. A method for laser scribing a wafer comprising:

laser scribing a first continuous line;

laser scribing a second continuous line spaced apart from the first continuous line; and

laser scribing a third continuous line, the third continuous line positioned between the first continuous line and the second continuous line.

23. A method for singulating dies from a wafer comprising:

laser scribing a first continuous line;

laser scribing a second continuous line spaced apart from the first continuous line;

laser scribing a third continuous line, the third continuous line positioned between the first continuous line and the second continuous line; and

passing a saw through the area of the first continuous line, the second continuous line and the third continuous line to cut the wafer.

29. An apparatus comprising:
- a laser adapted to direct laser energy toward a wafer;
 - a saw
 - a microprocessor for controlling the direction of the laser energy and controlling the movement of the saw;
 - a memory operatively coupled to the microprocessor;
 - said memory including an instruction set to cause a suitably programmed apparatus to laser scribe a first continuous line on a wafer; and
 - laser scribe an area near the first continuous line but not contacting the first continuous line.

32. A method for laser scribing a wafer comprising:
- laser treating a first area of the wafer;
 - laser treating a second area adjacent the first area; and
 - laser scribing a third continuous line, the third continuous line positioned between the first area and the second area.

THE EVIDENCE

The Examiner relies upon the following evidence:

Manor	US 6,420,245 B1	Jul. 16, 2002
Boyle	US 6,586,707 B2	Jul. 1, 2003
Peng	US 6,737,606 B2	May 18, 2004
Muraki	JP 53-002074 A	Jan. 10, 1978

Katagiri
Koizumi

JP 55-046579 A
JP H11-284278 A

Apr. 1, 1980
Oct. 15, 1999

THE REJECTIONS

The Appellants seek review of the following rejections:

1. The Examiner rejected claims 29-31 under 35 U.S.C. § 102 as anticipated by Koizumi or Manor or Peng.
2. The Examiner rejected claims 29-31 under 35 U.S.C. § 103(a) as unpatentable over Koizumi or Manor or Peng.¹
3. The Examiner rejected claims 16-21, 23-27, and 32-38 under 35 U.S.C. § 102(a) as anticipated by Katagiri or Muraki or Boyle.²
4. The Examiner rejected claims 16-21, 23-27, and 32-38 under 35 U.S.C. § 103(a) as unpatentable over Katagiri, Muraki, and Boyle.

¹ The Examiner stated this rejection using the disjunctive “or” between the listing of the references. As such, we understand this obviousness rejection to be based on each reference separately and not based on the collective teachings of all of the references.

² The Examiner rejected these claims as anticipated by Katagiri in view of Muraki and in view of Boyle. Since anticipation rejections are typically based on a single reference, we understand the Examiner’s anticipation rejection to be based on each reference separately; however, we interpret the Examiner’s alternative rejection under § 103 to be based on the collective teachings of the references due to the Examiner’s use of the “in view of” language in the rejection.

ISSUES

The Appellants argue claims 29-31 as a group. We select claim 29 as the representative claim, and claims 30 and 31 stand or fall with claim 29. 37 C.F.R. § 41.37(c)(1)(vii) (2008). The Appellants contend the Examiner erred in rejecting claim 29 because neither Koizumi, nor Manor, nor Peng discloses or suggests the claimed memory that includes an instruction set to cause a suitably programmed apparatus to “laser scribe a first continuous line on a wafer; and laser scribe an area near the first continuous line but not contacting the first continuous line.” App. Br. 10-11.

The first issue presented by this appeal is:

Have the Appellants shown the Examiner erred in finding that Koizumi, Manor, or Peng discloses or renders obvious the memory, including an instruction set, as called for in claim 29?

The Appellants argue claims 16-21 and 23-27 as a group. We select claims 16 and 23 as representative claims, and their respective dependent claims 17-21 and 24-27 stand or fall with claims 16 and 23. 37 C.F.R. § 41.37(c)(1)(vii). The Appellants contend the Examiner erred in rejecting claims 16 and 23 because neither Katagiri, nor Muraki, nor Boyle teaches laser scribing a third continuous line between the first and second lines. App. Br. 13-16.

The Appellants argue claims 32-38 as a group. We select claim 32 as the representative claim, and claims 33-38 stand or fall with claim 32. 37 C.F.R. § 41.37(c)(1)(vii). The Appellants contend the Examiner erred in rejecting claim 32 because neither Katagiri, nor Muraki, nor Boyle teaches

laser scribing a third continuous line between the first area and the second area. App. Br. 14, 16.

The second issue presented by this appeal is:

Have the Appellants shown the Examiner erred in determining that Katagiri, Muraki, and/or Boyle discloses or renders obvious laser scribing a third continuous line between first and second lines, as recited in claims 16 and 23, or between first and second areas, as recited in claim 32?

FINDINGS OF FACT

We find that the following enumerated findings are supported by at least a preponderance of the evidence. *Ethicon, Inc. v. Quigg*, 849 F.2d 1422, 1427 (Fed. Cir. 1988) (explaining the general evidentiary standard for proceedings before the Office).

1. Koizumi discloses a manufacturing device for laser diodes obtaining a laser diode chip by making cleavages on bar-shaped laser diodes. Koizumi 8, para. 0001. Koizumi does not explicitly disclose that the manufacturing device is controlled by a microprocessor having a memory with an instruction set. Koizumi, *passim*.
2. Manor describes a method and apparatus for laser scribing followed by mechanical dicing of semiconductor wafers. Manor, col. 1, ll. 13-14. Manor does not explicitly disclose that the apparatus is controlled by a microprocessor having a memory with an instruction set. Manor, *passim*.

3. Manor describes that “[l]aser energy sources, such as Excimer (UV) laser sources, described in the prior art to process silicon (U.S. Pat. No. 5,151,389 to Zappella, and U.S. Pat. No. 5,552,345 to Schrantz et al.) are examples of sources whose energy is readily absorbed by silicon.” Manor, col. 4, ll. 43-48.
4. Manor discloses that “[i]n U.S. Pat. No. 4,716,270 to Gnanamuthu et al. totally different physics [reflection versus absorption of the laser energy] are used to differentiate between laser processing of two layers of material.” Manor, col. 4, ll. 61-64.
5. Peng discloses a two-pass cutting procedure for processing wafers in which a first pass is made by a laser to scribe the workpiece, and a second pass is made by a mechanical cutter. Peng, col. 2, ll. 64-66.
6. Peng discloses that the apparatus includes an actuator 455, which includes stepper motors to control the position of table 452 on which the workpiece rests, and a controller 480, which is electrically connected to actuator 455, a laser 410, and a cutter 430, to control and coordinate operation of each. Peng, col. 5, ll. 32-34 and 62-66.
7. Peng discloses that the controller 480 is a computer having a processor and a memory, and that the memory stores data and instructions that are used by the processor to produce control signals for the devices connected to the controller. Peng, col. 5, l. 66 – col. 6, l. 3; *id.* at col. 9, ll. 40-46.

8. Peng discloses a wafer 920 that includes a plurality of dies 926 integrally connected by saw streets 921. Peng, col. 8, ll. 28-29; fig. 9. Peng discloses that the invention includes cutting wafer 920 using a laser 810 to remove material from a top portion of the wafer to create a scribe that extends along saw streets 921, and then completing each cut made by the scribe through the remaining portion of the wafer using the mechanical cutter. Peng, col. 8, ll. 58-67. As shown in Figure 9, the saw streets 921 and thus the corresponding scribe lines create a grid-like pattern across the wafer. Peng, fig. 9.
9. Katagiri discloses that it was known in the art to dice semiconductor wafers using a dicing saw or a blade scriber. Katagiri 3. Katagiri does not disclose the process for laser scribing lines on the wafers and does not disclose specifically the step of laser scribing a third continuous line positioned between first and second continuous lines. Katagiri, *passim*.
10. Muraki discloses that it was known in the art to scribe a silicon wafer to form scribe grooves and then crack the wafer into individual semiconductor devices along the scribe grooves using a roller. Muraki 4. Muraki discloses forming two adjacent scribe grooves and does not disclose or suggest forming a third scribe groove positioned between the first and second scribe grooves. Muraki, figs. 1-3.

11. Boyle discloses control of laser machining for processing semiconductor material, including machining by repeated scans so that material is removed in a sequence of steps from the surface downwards. Boyle, col. 1, ll. 5-8; *id.* at col. 2, ll. 9-12.
12. Figure 2 of Boyle shows an example of a cutting pattern for creating a long through-hole channel, such as is used in a microfluidic device, in the surface of a wafer using a combination of rastering 10 and window 11 cutting 10. Boyle, col. 5, ll. 19-22; fig. 2. As shown in Figure 2, the outer window is cut first, followed by the inner window, and then the raster pattern is cut.
13. The topmost horizontal line in the outer window is a first laser-scribed line, the bottommost horizontal line in the outer window is a second laser-scribed line, and the topmost horizontal line in the inner window is a third laser-scribed line positioned between the first and second lines.

PRINCIPLES OF LAW

“A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.” *Verdegaal Bros., Inc. v. Union Oil Co. of Cal.*, 814 F.2d 628, 631 (Fed. Cir. 1987). To establish anticipation, every element and limitation of the claimed invention must be found in a single prior art reference, arranged as in the claim. *Karsten Mfg. Corp. v. Cleveland Golf Co.*, 242 F.3d 1376, 1383 (Fed. Cir. 2001). In other words, there must be no

difference between the claimed invention and the reference disclosure, as viewed by a person of ordinary skill in the field of the invention. *Scripps Clinic & Research Found. v. Genentech Inc.*, 927 F.2d 1565, 1576 (Fed. Cir. 1991).

“Section 103 forbids issuance of a patent when ‘the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.’” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the prior art, (2) any differences between the claimed subject matter and the prior art, (3) the level of skill in the art, and (4) where in evidence, so-called secondary considerations. *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966). *See also KSR*, 550 U.S. at 407 (“While the sequence of these questions might be reordered in any particular case, the [*Graham*] factors continue to define the inquiry that controls.”)

ANALYSIS

Rejections of Claims 29-31

Claim 29 calls for an apparatus including a microprocessor for controlling the direction of the laser energy and controlling the movement of the saw, and a memory operatively coupled to the microprocessor and including an instruction set to cause a suitably programmed apparatus to

laser scribe a first continuous line on a wafer and laser scribe an area near the first continuous line, but not contacting the first continuous line.

We agree with the Appellants that neither Koizumi nor Manor discloses a memory operatively coupled to a microprocessor and including an instruction set as claimed. Neither Koizumi nor Manor explicitly discloses a microprocessor-controlled apparatus for controlling operation of a laser and a saw (Facts 1, 2). With respect to Manor, the Examiner found that “[i]nstruction sets are program control features, and looking at USPN 6,420,245 to Manor et al, at least two of the cited references (US 5,151,389 and US 4,716,270) describe computer control.” Ans. 5. Manor mentions these patents to describe prior art systems, and does not incorporate these systems by reference or disclose that such systems could be used within the apparatus disclosed in Manor (Facts 3, 4).

As such, Manor does not anticipate the claimed apparatus and the Examiner has not articulated a reason with rational underpinning to explain why a person having ordinary skill in the art would have been led by the teachings of these two prior art patents to modify the apparatus of Manor to make it microprocessor-controlled. Likewise, the Examiner has not articulated a reason with a rational underpinning to explain why a person having ordinary skill in the art would have been led to modify the apparatus of Koizumi to result in the claimed apparatus. As such, we cannot sustain the rejection of claims 29-31 as anticipated by, or obvious in view of, Koizumi or Manor.

As for Peng, however, we are not persuaded by the Appellants' argument that Peng fails to teach a memory with the claimed instruction set. Peng discloses a two-pass cutting procedure for processing wafers in which a first pass is made by a laser to scribe the workpiece, and a second pass is made by a mechanical cutter (Fact 5). Peng discloses that the apparatus includes an actuator 455, which includes stepper motors to control the position of table 452 on which the workpiece rests, and a controller 480, which is electrically connected to actuator 455, a laser 410, and a cutter 430, to control and coordinate operation of each (Fact 6). Peng discloses that the controller 480 is a computer having a processor and a memory and that the memory stores data and instructions that are used by the processor to produce control signals for the devices connected to the controller (Fact 7). Peng also discloses a wafer 920 that includes a plurality of dies 926 integrally connected by saw streets 921, that the wafer 920 is cut using a laser to remove material from a top portion of the wafer to create a scribe that extends along saw streets 921, and then completing each cut made by the scribe through the remaining portion of the wafer using the mechanical cutter (Fact 8). As shown in Figure 9, the saw streets 921, and thus the corresponding scribe lines, create a grid-like pattern across the wafer (Fact 8). Thus, Peng discloses a computer having a memory that includes an instruction set for causing a laser to scribe a first continuous line on a wafer (e.g., first scribe line along a first saw street 921) and to scribe an area near the first continuous line but not contacting the first continuous line (e.g. a second scribe line along a second saw street 921 running parallel to the first

saw street 921). As such, we sustain the Examiner's rejection of claims 29-31 as being anticipated by Peng.

A disclosure that anticipates under 35 U.S.C. § 102 also renders the claim unpatentable under 35 U.S.C. § 103, for anticipation is the epitome of obviousness. *See In re Pearson*, 494 F.2d 1399, 1402 (CCPA 1974); and *In re Fracalossi*, 681 F.2d 792, 794 (CCPA 1982). As such, we likewise sustain the Examiner's rejection of claims 29-31 as being unpatentable over Peng.

Rejections of claims 16-21 and 23-27

Anticipation

We agree with the Appellants that neither Katagiri nor Muraki discloses a method including laser scribing a third continuous line positioned between a first continuous, laser-scribed line and a second continuous, laser-scribed line.

Katagiri discloses that it was known in the art to dice semiconductor wafers using a dicing saw or a blade scriber (Fact 9). Katagiri does not disclose the process for laser scribing lines on the wafers and does not disclose specifically the step of laser scribing a third continuous line positioned between first and second continuous lines (Fact 9).

Muraki discloses that it was known in the art to scribe a silicon wafer to form scribe grooves and then crack the wafer into individual semiconductor devices along the scribe grooves using a roller (Fact 10). Muraki discloses forming two adjacent scribe grooves and does not disclose

or suggest forming a third scribe groove positioned between the first and second scribe grooves (Fact 10).

As such, we cannot sustain the Examiner's rejection of claims 16-21 and 23-27 as anticipated by Katagiri or Muraki.

Boyle, however, discloses control of laser machining for processing semiconductor material, including machining by repeated scans so that material is removed in a sequence of steps from the surface downwards (Fact 11). Figure 2 of Boyle shows an example of a cutting pattern for creating a long through-hole channel, such as is used in a microfluidic device, in the surface of a wafer using a combination of rastering 10 and window 11 cutting 10 (Fact 12). As shown in Figure 2, the outer window is cut first, followed by the inner window and then the raster pattern is cut. The topmost horizontal line in the outer window is a first laser-scribed line, the bottommost horizontal line in the outer window is a second laser-scribed line, and the topmost horizontal line in the inner window is a third laser-scribed line positioned between the first and second lines (Fact 13).

As such, Boyle anticipates the method of claim 16 which calls for laser scribing a first continuous line, laser scribing a second continuous line spaced apart from the first continuous line, and laser scribing a third continuous line positioned between the first and second lines.³

³ Claim 16 is not limited to completing the laser scribing steps in any particular order. Even if claim 16 were so construed, we find that the arrows representing the cutting pattern in Figure 2 of Boyle indicate that the outermost lines in the first window would be laser scribed in advance of the topmost horizontal line in the inner window (the third laser-scribed line).

Claim 23 further recites passing a saw through the area of the first continuous line, the second continuous line, and the third continuous line to cut the wafer. The example pattern of Figure 2 is used to machine the surface of a wafer used as a microfluidic device, and as such the wafer is not cut with a saw. Boyle, col. 2, ll. 60-62. As such, we will not sustain the rejection of claims 23-27 as anticipated by Boyle.

Obviousness

A disclosure that anticipates under 35 U.S.C. § 102 also renders the claim unpatentable under 35 U.S.C. § 103, for anticipation is the epitome of obviousness. See *In re Pearson*, 494 F.2d 1399, 1402 (CCPA 1974); and *In re Fracalossi*, 681 F.2d 792, 794 (CCPA 1982). As we found *supra*, Boyle anticipates claim 16. As such, we sustain the Examiner's rejection of claims 16-21 as obvious over Katagiri, Muraki, and Boyle.

The Examiner has failed to articulate a reason with rational underpinning as to why a person of ordinary skill in the art would have used the cutting pattern of Figure 2 of Boyle to singulate a die in a wafer, as called for in claim 23. As such, we will not sustain the Examiner's rejection of claims 23-27 as obvious over Katagiri, Muraki, and Boyle.

Rejections of claims 32-38

Anticipation

Claim 32 calls for a method for laser scribing a wafer that comprises laser treating a first area of the wafer, laser treating a second area adjacent

the first area, and laser scribing a third continuous line positioned between the first and second areas. We construe the steps of laser treating an area of the wafer to include laser scribing a line in a wafer, because the laser-scribed line has a width and a length and thus defines an area. As such, for the same reasons provided above in the analysis of claim 16, we find that neither Katagiri nor Muraki discloses the step of laser scribing a third continuous line positioned between first and second laser-treated areas (Facts 9, 10). As such, we do not sustain the Examiner's rejection of claims 32-38 as anticipated by Katagiri or Muraki.

We further find, based on the same reasons provided above in the analysis of claim 16, that Figure 2 of Boyle discloses the step of laser scribing a third continuous line positioned between first and second laser-treated areas of a wafer (Facts 11-13). As such, we sustain the Examiner's rejection of claims 32-38 as anticipated by Boyle.

Obviousness

A disclosure that anticipates under 35 U.S.C. § 102 also renders the claim unpatentable under 35 U.S.C. § 103, for anticipation is the epitome of obviousness. See *In re Pearson*, 494 F.2d 1399, 1402 (CCPA 1974); and *In re Fracalossi*, 681 F.2d 792, 794 (CCPA 1982). As we found *supra*, Boyle anticipates claim 32. As such, we sustain the Examiner's rejection of claims 32-38 as obvious over Katagiri, Muraki, and Boyle.

CONCLUSIONS

The Appellants have established that the Examiner erred in finding that Koizumi or Manor disclose or render obvious an apparatus having a memory including an instruction set, as called for in claim 29.

The Appellants have failed to show that the Examiner erred in finding that Peng discloses or renders obvious an apparatus having a memory including an instruction set, as called for in claim 29.

The Appellants have established that the Examiner erred in determining that Katagiri or Muraki anticipate laser scribing a third continuous line between first and second lines or first and second areas, as called for in claims 16, 23, and 32.

The Appellants have failed to establish that the Examiner erred in determining that Boyle discloses, or renders obvious in combination with Katagiri and Muraki, laser scribing a third continuous line between first and second lines, as recited in claim 16, or between first and second areas, as recited in claim 32.

The Appellants have shown the Examiner erred in determining that Boyle discloses, or renders obvious in combination with Katagiri and Muraki, laser scribing a third continuous line positioned between first and second continuous, laser-scribed lines, and passing a saw through the laser-scribed lines, as recited in claim 23.

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DECISION

We affirm the Examiner's decision to reject claims 16-21 and 29-38.
We reverse the Examiner's decision to reject claims 23-27.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a). *See* 37 C.F.R. § 1.136(a)(1)(iv) (2007).

AFFIRMED-IN-PART

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